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R/V W.E. RICKER Assemblage Survey of Hecate Strait, June 3 - 22, 1991

S. J. Wilson, J. Fargo, C. M. Hand,
T. Johansson, and A. V. Tyler

Biological Sciences Branch
Department of Fisheries and Oceans
Pacific Biological Station
Nanaimo, British Columbia V9R 5K6

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ABSTRACT

Wilson, S. J., J. Fargo, C. M. Hand, T. Johansson, and A. V. Tyler. 1991. R/V W.E. RICKER assemblage survey of Hecate Strait, June 3 - 22, 1991. Can. Data Rep. Fish. Aquat. Sci. 866: 179 p.

During the period June 3-June 22, 1991, R/V W.E. RICKER completed a synoptic trawl survey of groundfish species occupying the shelf area (10-80 fath; 18-146 m) of Hecate Strait. Previous surveys of this nature have been conducted in May-June 1984, February 1986, May-June 1987,and May-June 1989. The purpose of these surveys is to collect catch composition data to be used for classifying demersal fish assemblages. We will use this information to develop an ecological basis for stock assessment for the region. The secondary objective of the 1991 survey was to estimate the variance in catch-rates for major species within and among assemblages. This report contains summaries of the bridge log data and biological data collected on the survey, including weights and numbers for species caught, as well as length frequencies for species by haul (99 usable). A summary of temperature profiles from various locations in Hecate Strait is also included.

RÉSUMÉ

Wilson, S. J., J. Fargo, C. M. Hand, T. Johansson, and A. V. Tyler. 1991. R/V W.E. RICKER assemblage survey of Hecate Strait, June 3 - 22, 1991. Can. Data Rep. Fish. Aquat. Sci. 866: 179 p.

Du 3 au 22 juin 1991, le R/V W.E. RICKER a achevé une campagne de chalutage synoptique des espèces de poissons de fond fréquentant la plate-forme (de 10 à 80 brasses; de 18 à 146 m) du détroit d'Hécate. Des relevés de cette nature avaient déjà été effectués en mai et juin 1984, en février 1986, mai et juin 1987, ainsi qu'en mai et juin 1989. Ils ont pour objectif la collecte de données sur la composition de captures, en vue de la classification des assemblages de poissons de fond. L'information ainsi recueillie servira à l'établissement d'une base écologique en vue de l'évaluation du stock dans la région. Le relevé de 1991 avait également pour but de fournier une estimation de l'écart dans les taux de captures pour les principales espèces au sein des assemblages et entre ceux-ci. Le présent rapport contient des résumés des données du carnet de passerelle et des données biologiques recueillies dans le cadre du relevé, notamment le poids et le nombre, pour les espèces capturées, ainsi que les fréquences de longueur par halage (99 utilisables). Un résumé des profils de température en divers endroits du détroit d'Hécate y figure également.

INTRODUCTION

This survey was carried out as part of the Pacific Biological Station's Hecate Strait Project. Our purpose was to develop an ecological basis for stock assessment, by using species catch composition data from several synoptic surveys to map the distribution of on-bottom fish assemblages in Hecate Strait. A secondary objective of this survey was to examine the catch-rate variability for species. To collect data for this analysis, we replicated trawl hauls at pre-selected sites that were representative of species compositions for three distinct assemblages in the Strait.

This survey was the fifth in a series of groundfish assemblage surveys that have been conducted in Hecate Strait since 1984. Surveys have been made in different years, and in summer and winter, to examine inter-annual and inter-seasonal variability within assemblages. The first two surveys were conducted as joint operations with a chartered fishing vessel and a fisheries research vessel (Fargo et al. 1984, Westrheim et al. 1984, Fargo and Davenport 1986 and Foucher et al. 1988). The third and fourth surveys were conducted by a single, chartered fishing vessel (Fargo et al. 1988 and Antonsen et al. 1990), while this survey employed the use of a Fisheries research vessel.

METHODS AND MATERIALS

FISHING VESSEL

We used the R/V W.E. RICKER, a 57.3 m (overall length) steel stern trawler, for the survey. The vessel is equipped with a stern ramp, three net drums and two main winches with 1.5" warps. A separate winch and platform were used for oceanographic work.

FISHING GEAR

The gear consisted of a Yankee 36 trawl net (Fig. 1) connected to the vessel's 2000 lb (900 kg) steel doors. A conventional groundline consisting of 16.3-cm rubber discs was used. The headrope of the net contained 24 15.2-cm round plastic floats. The net had 9.0-cm mesh in the wings and body and 2.5-cm mesh in the codend.

SURVEY DESIGN

Locations for trawling sites on the survey were assigned over a grid of 10x10 nm (18.5 km) blocks over a depth range of 10-80 fathoms (18-146 m), where each 10 fathom depth interval within a block was considered a potential sampling stratum. A total of 100 trawl hauls were made within seven strata. Each stratum fell into one of three categories; receiving six replicate tows, three replicate tows, or a single tow. Haul duration was 30 minutes.

Replicate tows were tows made, one after another, along a set trackline. For the strata receiving six replicates, two sets of three replicates were made on parallel tracklines, with the second set made at a distance no less than 5 nm from the first set. For the strata receiving 3 replicates, one set of three replicates was made. The initial fishing positions for all strata were the same as positions recorded for that strata from the previous survey (Antonsen et al. 1990). We pre-selected the replicated strata to be representative of the species composition for one of three specific fish assemblages within Hecate Strait (Fargo and Tyler 1991). These data will be used to estimate the variance in species' catch-rates within and among assemblages.

CATCH PROCESSING

Once on board, the catch from each trawl haul was dumped into a large hopper below deck, from which the fish were released onto a conveyor belt. From there, they were sorted by species into plastic tubs (ca. 50 kg capacity), and weighed to the nearest kilogram using a platform deck balance, which was calibrated daily. The total weight for each species was equal to the sum of the individual tub weights for that species.

LENGTH FREQUENCIES

We measured fork length or total length to the nearest cm for all specimens caught except ratfish; which were measured to the posterior edge of the third dorsal fin (Foucher et al., 1988) We used the plastic strip method (Davenport and Harling, 1965) to obtain length frequencies for individual species for each haul. For dogfish, sex was also recorded, based on external characteristics.

We did not measure all specimens caught in all cases. Exceptions were A) replicate hauls, where lengths were taken for only the first replicate in the set, B) large catches of individual species, whereupon subsampling was done as outlined by Westrheim (1967), and C) species not measured due to

oversight. Usually, this involved a species constituting a very small proportion, by weight, of the haul.

ADDITIONAL BIOLOGICAL DATA

We took length and weight measurements for each big and longnose skate caught. Length was taken as the total length from the tip of the nose to the end of tail. Weight was measured to the nearest 0.1 kg using a spring balance, which was calibrated daily. We collected this data to develop a length-weight relationship for skate that can be used to calculate the total weight of skate caught and discarded in the commercial fishing industry, based on length measurements taken by observers in the domestic trawl fishery.

External lesions were observed on a small number of flatfish. We collected specimens from three species--rex sole, sand sole, and Dover sole. These samples were examined by a fish pathologist at the Pacific Biological Station.

TEMPERATURE DATA

During the course of the survey, a Sippican Ocean Systems, Expendable Bathythermograph (XBT) was cast at each trawl station. At stations where tows were replicated, only one cast was made, with two exceptions. At station B204, casts were made on the first and third tows out of six, and at station B301 casts were made on the first and fourth tows out of six. Temperatures were recorded by the XBT probe at 0.5 m depth intervals.

RESULTS

TRAWLING SCHEME

We completed a total of 100 hauls, of which 99 were deemed "usable" (Fig. 2). The unusable haul, haul 50, was terminated early because the net snagged on the bottom. Six replicate hauls were performed at five stations (B204, C305, B301, I302, I405/J505); three replicate hauls were performed at six stations (B106, B103, H302, E405, F403, F406). The remaining stations were not replicated (Table 1).

PRINCIPAL SPECIES CAUGHT

The total catch from usable hauls was 58,334 kg, comprising 57 species. An index to common and scientific names of each species is contained in Table 2. We have revised the common and scientific names of several species used in reports for previous surveys. These changes reflect the nomenclature recommended by McAllister (1990). Specific changes are noted in footnotes in Table 2. Also specimens denoted as juvenile rockfish on previous surveys were probably S. wilsoni. Principal species by weight were arrowtooth flounder (33.4%), English sole (11.6%), and ratfish (9.9%), -- 54.9% of the total catch. Principal species by numbers were English sole (29.6%), arrowtooth flounder (17.4%), and rex sole (13.8%), -- 60.8% of the total catch (Table 3). Detailed records of all the trawl hauls and catch weights by species are presented in appendix table 1.

LENGTH FREQUENCIES

We recorded lengths (to the nearest cm) for 46,575 specimens in 65 hauls (est. 95,097 specimens for hauls measured). Appendix tables 2-56 contain length-frequency records, by haul, for each species measured. An index to these records is presented in Table 3. Records of the total number of individuals and total weight, by species, for hauls measured for length, as well as the total weight for each species caught in all usable hauls, are also included in Table 3.

Catch subsampling occurred for one or more species in 43 hauls (Table 4). Estimates for the total number of fish caught in such cases were derived using the following equation:

$$n = Nw/W$$

where:
n = total number of a given species caught,
N = number of a given species measured,
w = total weight of a given species caught,
W = weight of a given species measured.

SKATE LENGTH-WEIGHT RELATIONSHIP

Length-weight regressions were performed separately on data collected for big and longnose skate. The results of a statistical F-test indicated that the regression coefficients for the two regressions differed significantly ($p < 0.001$ for both). The regression relationships for the two species are presented in Figures 3 and 4.

The length-weight relationship for big skate was calculated as:

$$W = (3.65 \times 10^{-6}) L^{3.156}$$

The length-weight relationship for longnose skate was calculated as:

$$W = (1.44 \times 10^{-7}) L^{3.862}$$

where:
W = weight (kg)
L = length (cm)

ADDITIONAL BIOLOGICAL DATA

The external lesions examined on collected specimens were determined to be x-cell lesions. Dawe (1981) concluded that "x cells are individuals of some protistan species, possibly a member of the family Hartmannellidae" (op. cit. p. 41). This hypothesis is now generally accepted by the scientific community.

TEMPERATURE DATA

Temperatures, as recorded by the XBT probe, ranged from 8.8 to 11.7°C at the surface and from 5.9 to 12.0°C on the bottom (Table 6). The surface temperature was generally cooler on this survey (mean SST = 10.27°C) than on the previous survey (mean SST = 10.96°C) (Antonsen et al., 1990). The water column at four stations (C201, H201, G301, and J401) was isothermal, and at station B301, an anomalous temperature profile was recorded. The thermocline here was inverted, with a surface temperature of 8.9°C, and a bottom temperature of 12.0°C.

PERSONNEL

A. V. Tyler	(i/c)	Pacific Biological Station	June 3 - 22
S. J. Wilson		"	June 3 - 22
J. Fargo		"	June 3 - 22
C. M. Hand		"	June 3 - 22
T. Johansson		"	June 4 - 22

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Table 1. Inventory of hauls, by block and depth strata, completed by the R/V W.E. RICKER, June 3 - 22, 1991.

Block-strata	Haul
A207	1
A303	9
A304	11
A306	10
B103	17,18,19
B105	12
B106	14,15,16
B107	13
B204	2,3,4,5,6,8
B207	7
B205	20
B301	21,22,23,24,25,26
B304	29
C201	27
C301	28
C303	33
C305	30,31,32,34,35,36
D302	37
D303	41
E202	38
E303	40
E402	39
E405	42,43,44
E407	45
F201	49
F303	48
F403	58,59,60
F404	46
F405	56
F406	57,61,62
F407	47
G301	51
G303	52
G305	53
G405	54
G407	55
H201	50
H301	66
H302	63,64,65
H405	67
H406	68
H407	69
I201	75
I301	74
I302	71,72,73,76,77,78
I303	79
I401	85
I402	84
I404	70
I405	81,82,83
I506	92
I507	80
J204	87
J301	86
J401	91
J402	90
J404	89
J504	88
J505	94,95,96
J506	93
K404	99
K406	98
K506	97
L406	100

Table 2. List of common and scientific names of all fish species caught during R/V W.E. RICKER assemblage survey of Hecate Strait, June 3-22, 1991.

Common name	Scientific name
Flatfish	
Arrowtooth flounder	Atheresthes stomias
Pacific sanddab	Citharichthys sordidus
Petrale sole	Eopsetta jordani
Rex sole	Glyptocephalus zachirus
Flathead sole	Hippoglossoides elassodon
Pacific halibut	Hippoglossus stenolepis
Butter sole	Isopsetta isolepis
Rock sole	Lepidopsetta bilineata
Slender sole	Lyopsetta exilis
Dover sole	Microstomus pacificus
English sole	Parophrys vetulus
Starry flounder	Platichthys stellatus
C-O sole	Pleuronichthys coenosus
Curlfin sole	Pleuronichthys decurrens
Sand sole	Psettichthys melanostictus
Rockfish	
Pacific ocean perch	Sebastes alutus
Redbanded rockfish	S. babcocki
Silvergray rockfish	S. brevispinis
Copper rockfish	S. caurinus
Greenstriped rockfish	S. elongatus
Widow rockfish	S. entomelas
Yellowtail rockfish	S. flavidus
Shortbelly rockfish	S. jordani
Quillback rockfish	S. maliger
Bocaccio	S. paucispinis
Canary rockfish	S. pinniger
Redstripe rockfish	S. proriger
Yelloweye rockfish	S. ruberrimus
Pygmy rockfish	S. wilsoni
Shortspine thornyhead	Sebastolobus alascanus
Roundfish	
Sturgeon poacher	Agonus acipenserinus
Pacific sand lance	Ammodytes hexapterus
Wolfeel	Anarrhichthys ocellatus
Sablefish	Anoplopoma fimbria
Pacific herring	Clupea harengus pallasi
Pacific saury	Cololabis saira
Black-eyed goby	Coryphopterus nicholsi
Pacific cod	Gadus macrocephalus
Kelp greenling	Hexagrammos decagrammus
Surf smelt	Hypomesus pretiosus pretiosus
Pacific staghorn sculpin	Leptocottus armatus
Slimy snailfish	Liparis mucosus
Snake prickleback	Lumpenus sagitta
Bigfin eelpout	Lycodes[1] cortezianus
Pacific tomcod	Microgadus proximus
Sailfin sculpin	Nautichthys oculofasciatus
Chinook salmon	Oncorhynchus tshawytscha
Lingcod	Ophiodon elongatus
Tadpole sculpin	Psychrolutes paradoxus
Eulachon	Thaleichthys pacificus
Walleye pollock	Theragra chalcogramma
Pacific sandfish	Trichodon trichodon
Ribbed sculpin	Triglops pingeli
Selachii	
Sandpaper skate[2]	Bathyraja interrupta[3]
Spotted ratfish[4]	Hydrolagus colliei
Big skate	Raja binoculata
Longnose skate	Raja rhina
Spiny dogfish	Squalus acanthias

1 formerly Aprodon
2 formerly black skate
3 formerly Raja kincaidi
4 formerly ratfish

Table 3. Weight (kg) and numbers measured for length frequencies, by species, of fish specimens caught in usable hauls during W.E. RICKER assemblage survey of Hecate Strait, June 3 - 22, 1991.

	Total weight (kg)	Weight in hauls measured for length (kg)	Number measured for length	Appendix table
Flatfish				
Arrowtooth flounder	19,469	8,710	16,557	13
Butter sole	266	201	636	19
C-O sole	1	1	6	56
Curlfin sole	26	7	37	36
Dover sole	3,917	2,301	6,083	17
English sole	6,759	4,570	28,178	16
Flathead sole	259	181	1,197	18
Pacific Halibut	3,056	1,965	362	7
Pacific sanddab	565	344	2,374	27
Petrale sole	429	422	301	21
Rex sole	4,344	2,157	13,094	9
Rock sole	1,642	1,373	3,551	32
Sand sole	219	100	332	31
Slender sole	41	23	272	45
Starry flounder	42	23	8	29
Subtotal	41,035	22,378	72,988	
Rockfish				
Pacific ocean perch	223	203	625	11
Redbanded rockfish	148	148	53	47
Silvergray rockfish	111	100	73	26
Copper rockfish	9	9	11	40
Greenstripe rockfish	2	2	5	50
Widow rockfish	11	1	2	49
Yellowtail rockfish	1,155	265	489	22
Shortbelly rockfish	100	100	187	52
Quillback rockfish	147	118	120	24
Bocaccio	25	25	5	37
Canary rockfish	417	381	386	48
Redstripe rockfish	669	666	1,710	44
Yelloweye rockfish	9	9	3	51
Pygmy rockfish	22	24	377	43
Shortspine thornyhead	1	1	3	2
Subtotal	3,049	2,052	4,049	

Table 3 (cont'd)

	Total weight (kg)	Weight in hauls measured for length (kg)	Number measured for length	Appendix table
Other roundfish				
Bigfin eelpout	Tr	Tr	22	46
Chinook salmon	Tr	Tr	1	30
Eulachon	10	4	326	10
Blackeye goby	Tr	Tr	1	38
Kelp greenling	21	21	54	39
Lingcod	800	633	110	15
Pacific cod	1,626	1,078	1,392	8
Pacific herring	9	9	167	20
Pacific sand lance	Tr	Tr	47	42
Pacific saury	Tr	Tr	1	55
Pacific staghorn sculpin	4	4	40	33
Pacific tomcod	10	10	129	35
Ribbed sculpin	Tr	Tr	4	41
Sablefish	817	448	813	12
Sailfin sculpin	Tr	Tr	1	41
Slimy snailfish	Tr	Tr	1	-
Snake prickleback	Tr	Tr	1	53
Sturgeon poacher	11	4	359	34
Surf smelt	1	1	13	54
Tadpole sculpin	Tr	Tr	1	41
Walleye pollock	1,796	544	1,212	23
Wolfeel	15	15	3	25
Subtotal	5,120	2,771	4,734	
Selachii				
Big skate	855	271	112	28
Sandpaper skate	46	39	39	3
Longnose skate	108	43	30	6
Spotted ratfish	5,784	3,862	12,323	14
Spiny dogfish	2,337	1,175	822	4/5
Subtotal	9,130	5,390	13,326	
Grand total	58,334	32,591	95,097	

Table 4. Calculated numbers of specimens, by species, caught for hauls in which all specimens caught were not measured during R/V W.E. RICKER assemblage survey of Hecate Strait June 3 - 22, 1991.

Haul no.	Species	Weight (kg)		Numbers	
		Sample	Total	Sample	Total
02	Arrowtooth flounder	181	644	131	466
07	Dover sole	139	300	194	419
09	English sole	87	240	360	993
09	Spotted ratfish	85	335	192	757
09	Arrowtooth flounder	83	224	514	1387
10	Spotted ratfish	83	127	482	738
10	Dover sole	134	238	163	290
11	Ratfish	90	1257	326	4553
11	English sole	133	267	413	829
12	English sole	52	208	99	396
12	Rex sole	159	238	326	488
12	Spiny dogfish	28	55	18	35
12	Dover sole	92	282	106	325
12	Arrowtooth flounder	81	964	99	1178
12	Spotted ratfish	92	720	181	1417
13	Spotted ratfish	49	67	87	119
13	Arrowtooth flounder	47	381	141	1143
14	Spotted ratfish	82	235	148	424
14	Arrowtooth flounder	136	564	181	751
17	Arrowtooth flounder	130	810	107	667
17	Spiny dogfish	211	282	236	315
20	Arrowtooth flounder	139	903	98	637
24	English sole	23	165	260	1865
27	Butter sole	114	156	330	452
27	English sole	32	43	339	456
28	English sole	31	101	325	1059
29	Rex sole	49	159	286	928
29	Dover sole	88	121	355	488
29	English sole	88	115	295	386
29	Spotted ratfish	44	259	178	1048
30	English sole	88	196	284	633
30	Arrowtooth flounder	129	277	78	168
33	English sole	82	530	447	2889
33	Rex sole	36	94	454	1185
33	Pacific cod	84	116	143	197
38	Spotted ratfish	83	132	156	248
39	Rock sole	31	57	242	445
40	English sole	39	95	164	399
41	English sole	41	48	219	256
41	Arrowtooth flounder	44	54	217	266
42	Rex sole	44	182	347	1435
45	Arrowtooth flounder	130	169	188	244
45	Dover sole	45	228	199	1008

Table 4 (cont'd)

Haul no.	Species	Weight (kg) Sample	Weight (kg) Total	Numbers Sample	Numbers Total
45	Rex sole	44	92	258	539
46	Arrowtooth flounder	112	145	148	192
46	Rex sole	40	103	316	814
47	Rex sole	40	147	216	794
47	Dover sole	39	89	193	440
53	Rex sole	45	97	325	701
53	English sole	82	100	347	423
53	Spotted ratfish	19	49	167	431
54	Arrowtooth flounder	126	146	160	185
54	Rex sole	35	56	195	312
54	Spotted ratfish	22	40	195	355
55	Arrowtooth flounder	152	321	269	581
55	Rex sole	45	62	157	216
55	Dover sole	89	168	148	279
56	Yellowtail rockfish	74	240	141	457
56	Redstripe rockfish	71	648	181	1652
56	Shortbelly rockfish	42	99	175	413
57	Rex sole	47	106	318	717
58	Arrowtooth flounder	82	143	143	249
58	English sole	84	233	297	824
65	Pacific cod	93	143	290	446
65	English sole	3	5	283	472
65	Pacific sanddab	38	75	298	588
69	Dover sole	85	206	180	436
69	Rex sole	41	153	181	675
69	English sole	44	53	119	143
70	Rex sole	43	123	406	1161
70	English sole	75	232	538	1664
71	English sole	40	213	372	1981
71	Pacific sanddab	41	79	333	642
79	English sole	40	54	529	714
80	Arrowtooth flounder	125	455	302	1099
80	Rex sole	38	49	198	255
84	English sole	16	405	269	6809
84	Rock sole	127	253	188	375
87	Dover sole	21	40	166	316
87	English sole	12	72	154	924
92	Arrowtooth flounder	10	157	246	3862
92	English sole	74	96	194	252
93	Arrowtooth flounder	192	519	156	422
94	Canary rockfish	184	340	171	316
98	English sole	52	70	276	372
100	English sole	39	50	220	282

Table 5. Expendable bathythermograph (XBT) profiles from the R/V W.E. RICKER assemblage survey Hecate Strait, June 3 - 22, 1991. Temperatures in degrees C at 10 m intervals.

Block	A207	B204	B204	A303	A306	A304	B105	B107	B106
Set No.	1	2	4	9	10	11	12	13	14
Drop No.	1	2	3	4	5	6	7	8	9
Depth(m)									
10	8.6	8.5	8.5	8.7	8.9	8.8	8.7	9.0	8.5
20	8.6	8.4	8.5	8.4	8.5	8.7	8.6	8.2	8.2
30	7.2	7.4	8.4	7.7	7.7	8.4	8.4	7.7	7.9
40	7.0	7.0	8.2	7.4	7.3	7.7	8.3	7.2	7.1
50	6.8	6.7	7.7		7.0	7.0	7.7	6.8	6.8
60	6.7	6.5	7.4		6.8	6.8	7.0	6.8	6.7
70	6.5	6.4	7.3		6.6	6.6	6.9	6.6	6.7
80	6.4	6.2	7.2		6.3		6.6	6.5	6.6
90	6.3	6.1			6.2		6.5	6.3	6.4
100	6.3				6.1			6.3	6.2
110	6.1				6.1			6.2	6.1
120	6.1				5.9			6.1	6.1
130	6.1							5.9	6.1
140	6.1								
SST[1] (bucket)	8.9	9.0	8.8	8.9	10.0	9.0	9.0	9.0	9.3
Bottom temp	6.1	6.1	7.2	7.4	5.9	6.6	6.5	5.9	6.1
Bottom depth (m)	150	91	76	64	117	74	95	135	126

Block	B103	B205	B301	B301	C201	C301	B304	C305	C303
Set No.	17	20	21	24	27	28	29	30	33
Drop No.	10	11	12	14	15	16	17	18	19
Depth (m)									
10	9.1	8.4	9.7	8.6	10.1	9.9	9.1	9.7	9.7
20	8.7	8.0	10.7	8.6	10.1	9.8	9.0	9.7	9.6
30	8.4	7.4	12.0	8.6		9.1	8.9	9.6	9.5
40	7.4	6.8					8.7	9.4	9.5
50	7.2	6.6					8.4	8.3	9.6
60	7.0	6.4					7.5	7.6	9.6
70	6.8	6.3					7.1	7.2	8.4
80		6.1					6.8	6.9	
90		6.1					6.5	6.6	
100									
110									
120									
130									
SST[1] (bucket)	9.3	9.1	8.9	8.9	10.0	10.0	9.5	9.7	9.9
Bottom temp	6.8	6.1	12.0	8.6	10.0	9.1	6.5	6.6	8.4
Bottom depth (m)	68	95	25	29	30	37	85	92	72

Table 5 (cont'd)

Block	D302	E202	E402	E303	D303	E405	E407	F404	F407
Set No.	37	38	39	40	41	42	45	46	47
Drop No.	20	21	22	23	24	25	26	27	28
Depth (m)									
10	10.3	10.4	10.2	9.9	9.3	10.2	9.6	9.8	9.3
20	10.1	10.4	9.9	9.2	9.4	10.0	9.5	9.2	8.9
30	9.7	9.4	9.5	8.4	9.3	9.1	9.3	9.0	8.2
40	8.5	9.1	8.6	7.7	8.8	8.4	9.0	8.6	7.8
50			8.6	7.5	8.1	7.9	8.1	8.4	7.3
60				7.5	7.4	7.3	7.2	7.1	6.8
70						7.3	6.9	6.9	6.8
80						7.1	6.8	6.8	6.7
90						6.9	6.8		6.6
100							6.8		6.6
110							6.8		6.6
120							6.7		6.6
130							6.7		6.8
140									6.7
SST[1] (bucket)	10.4	10.6	10.4	10.5	10.0	10.5	9.6	10.4	10.5
Bottom temp	8.3	9.1	8.6	7.5	7.2	6.8	6.7	6.8	6.7
Bottom depth(m)	40	44	52	61	65	96	134	84	142

Block	F303	F202	H201	G301	G303	G305	G405	G407	F405
Set No.	48	49	50	51	52	53	54	55	56
Drop No.	29	30	31	32	33	34	35	36	40
Depth (m)									
10	9.4	9.8	10.2	9.8	10.2	10.7	10.0	10.3	10.2
20	9.2	9.8	10.2	9.8	9.9	10.7	9.6	10.2	10.1
30	8.6		10.2		9.2	9.5	9.1	9.4	9.7
40	8.3				9.0	9.1	8.8	9.0	8.9
50	8.2				9.0	8.1	8.3	8.3	8.4
60	8.2					7.8	8.0	7.8	7.8
70	8.2					7.4	7.6	7.4	7.7
80						7.3	7.0	7.1	7.3
90						7.3	6.8	7.0	6.9
100						7.3	6.7	6.9	
110							6.6	6.8	
120								6.6	
130								6.6	
140								6.6	
SST[1] (bucket)	10.2	10.0	10.2	9.9	10.3	10.6	10.4	10.6	10.2
Bottom temp	8.2	9.7	10.2	9.8	9.0	7.3	6.6	6.6	6.9
Bottom depth (m)	68	28	25	26	49	98	107	144	96

Table 6 (cont'd)

Block	F406	F403	H302	H301	H405	H406	H407	I404	I302
Set No.	57	58	65	66	67	68	69	70	71
Drop No.	41	42	43	44	45	46	47	48	49
Depth (m)									
10	9.6	9.9	9.6	9.8	9.1	10.8	10.8	10.7	11.0
20	9.6	9.9	9.3	9.8	8.8	10.1	10.5	10.4	9.9
30	9.4	9.3	9.2	9.8	8.2	9.7	10.2	9.4	9.4
40	8.5	8.4	9.2		7.8	9.0	9.7	9.0	9.0
50	8.1	7.7			7.4	8.0	9.0	8.5	8.8
60	7.3	7.5			7.1	7.6	8.5	8.3	
70	6.9	7.4			7.1	7.2	7.7	8.2	
80	6.7				7.1	6.9	7.7	8.2	
90	6.7				7.1	6.8	7.3		
100	6.5				7.1	6.8	6.9		
110	6.5						6.8		
120							6.8		
130							6.7		
140							6.6		
SST[1] (bucket)	9.3	9.9	10.0	10.1	11.2	11.5	11.2	11.3	10.9
Bottom temp	6.5	7.4	9.1	9.8	7.1	6.3	6.7	8.1	8.7
Bottom depth (m)	114	70	35	30	98	115	141	87	50

Block	I301	I202	I303	I507	I405	I402	I401	J301	J204	J504
Set No.	74	75	79	80	81	84	85	86	87	88
Drop No.	50	51	52	53	54	55	56	57	58	59
Depth (m)										
10	9.7	10.2	10.4	11.1	10.9	10.0	9.9	10.7	9.6	10.2
20	9.4	10.2	9.9	10.8	10.7	9.7	9.6	10.3	9.2	10.2
30	9.4	10.2	9.1	9.1	10.1	9.3		10.3	8.8	9.8
40			9.1	8.8	9.0	9.0			8.6	9.5
50			9.0	8.2	8.2	9.0			8.5	9.1
60			8.9	7.4	7.8	8.9			8.2	8.7
70				7.0	7.6				8.1	7.6
80				6.9	7.0					7.4
90				6.7	6.7					
100				6.5	6.6					
110				6.5						
120				6.3						
130				6.3						
SST[1] (bucket)	11.0	10.7	11.3	11.1	11.1	11.0	11.0	11.1	10.7	10.5
Bottom temp	9.4	10.2	8.9	6.3	6.6	8.9	9.6	10.3	8.1	7.4
Bottom depth (m)	28	29	60	134	107	59	26	30	88	82

Table 5 (cont'd)

Block	J404	J402	J401	I506	J506	J505	K506	K406	K404	L406
Set No.	89	90	91	92	93	94	97	98	99	100
Drop No.	60	61	62	63	64	65	66	67	68	70
Depth (m)										
10	10.9	10.9	11.4	11.0	11.1	10.5	9.6	11.4	10.4	11.5
20	10.7	9.9	11.4	9.3	9.2	10.3	9.6	11.3	10.3	9.9
30	8.7	8.8	11.4	8.5	8.6	9.5	9.6	9.7	10.1	9.2
40	8.4	8.6	11.3	8.2	8.1	8.2	8.6	8.2	9.2	8.2
50	8.0	8.4		7.9	7.9	7.7	7.9	7.8	8.4	8.0
60	7.7	8.2		7.6	7.7	7.7	7.6	7.4	8.0	7.8
70	7.6			7.4	7.5	7.5	7.2	7.1	8.2	7.3
80				7.2	7.4	7.2	6.8	7.0	7.7	7.1
90				6.9	7.3	6.9	6.8	6.8		7.0
100				6.8	6.9		6.7	6.7		7.0
110				6.8	6.8		6.7	6.6		6.7
120				6.7			6.8	6.5		6.6
130										
SST[1] (bucket)	11.1	11.0	11.4	11.2	11.2	10.7	10.0	11.4	10.4	11.7
Bottom temp	7.6	8.2	11.3	6.7	6.8	6.9	6.8	6.5	7.7	6.6
Bottom depth (m)	84	55	38	123	112	94	120	122	84	118

[1]Sea surface temperature

NET DIMENSIONS AND CHARACTERISTICS FOR BOTTOM TRAWL

VESSEL W. E. RICKER NET Yankee 36

OBSERVATION PERIOD June 3-22, 1991

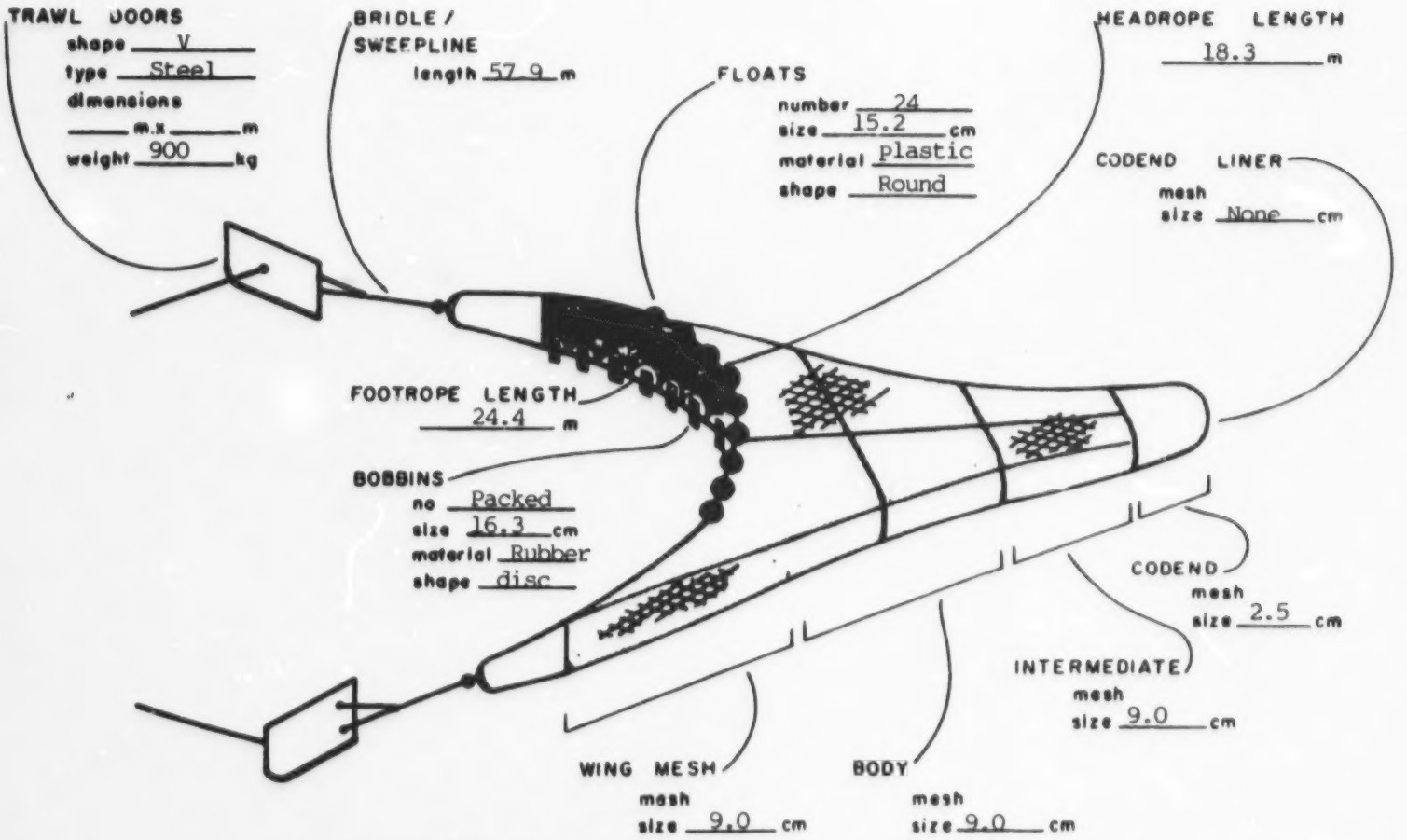

Fig. 1. Net dimensions and characteristics for the Yankee 36 trawl net used by R/V W.E. RICKER on species assemblage survey June 3-22, 1991.

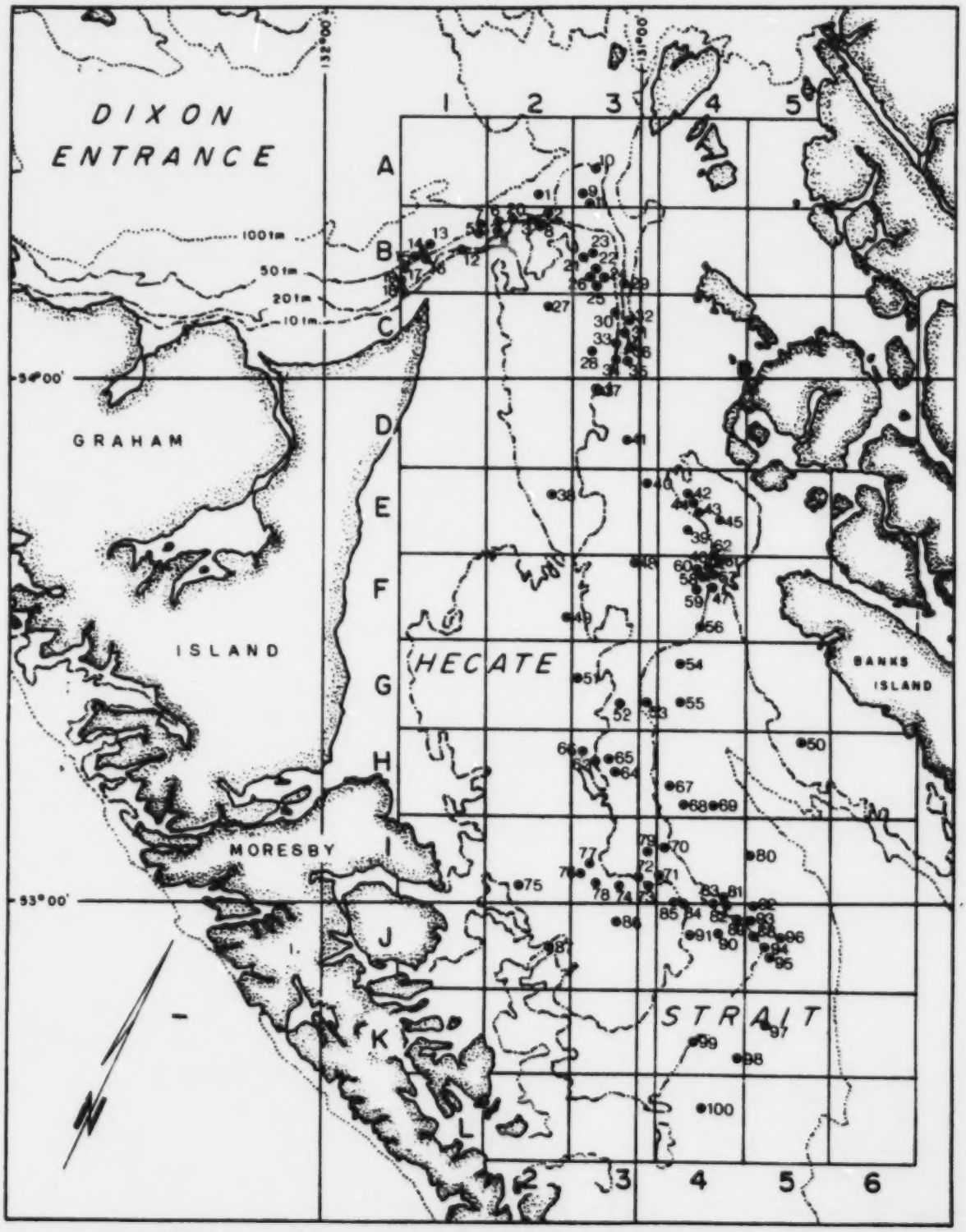

Fig. 2. Locations of trawl hauls made by R/V W.E. RICKER on species assemblage survey June 3-22, 1991.

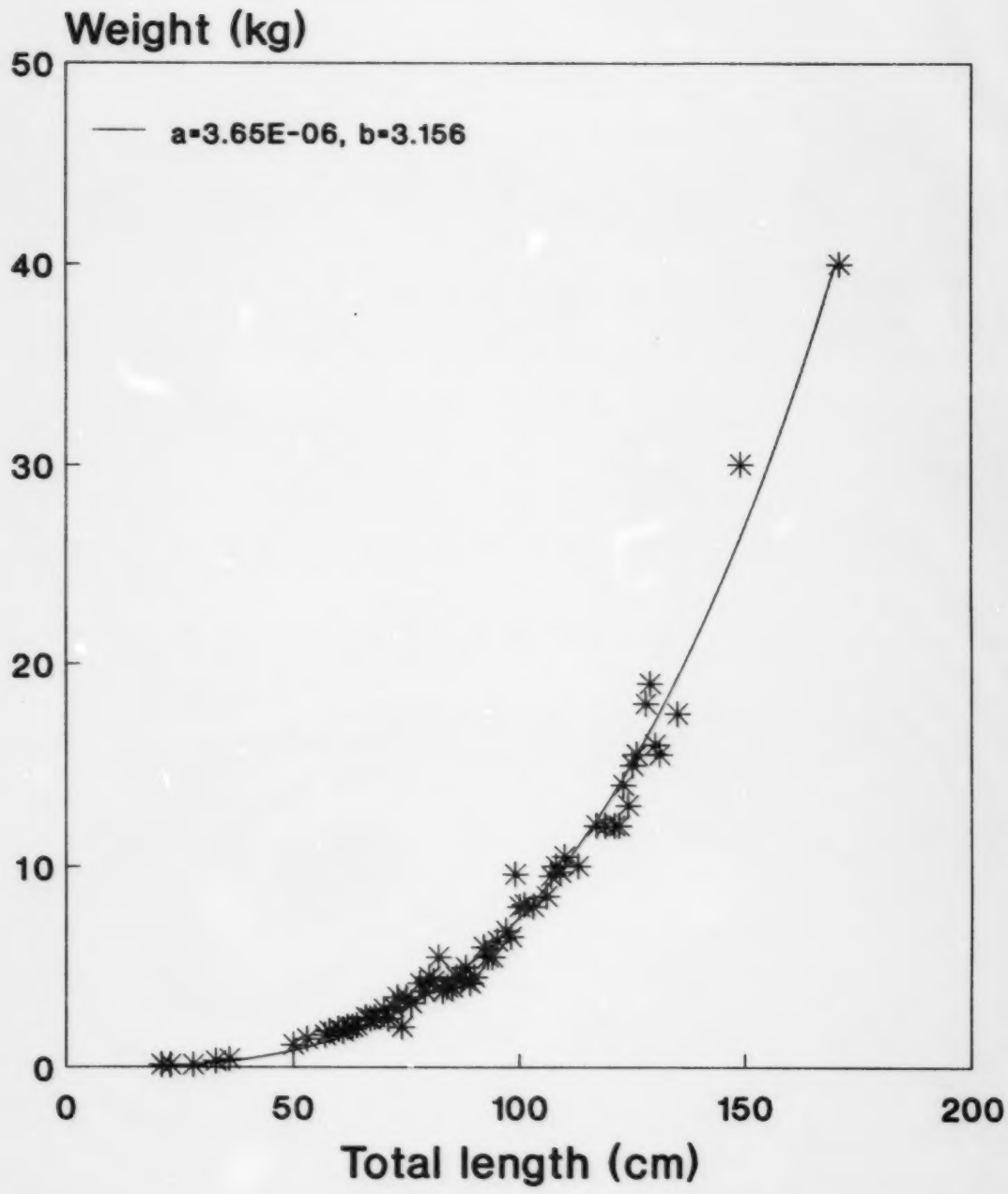

Fig. 3. Length-weight relationship for Big skate (Raja binoculata) caught on species assemblage survey of Hecate Strait by R/V W.E. RICKER, June 3-22, 1991.

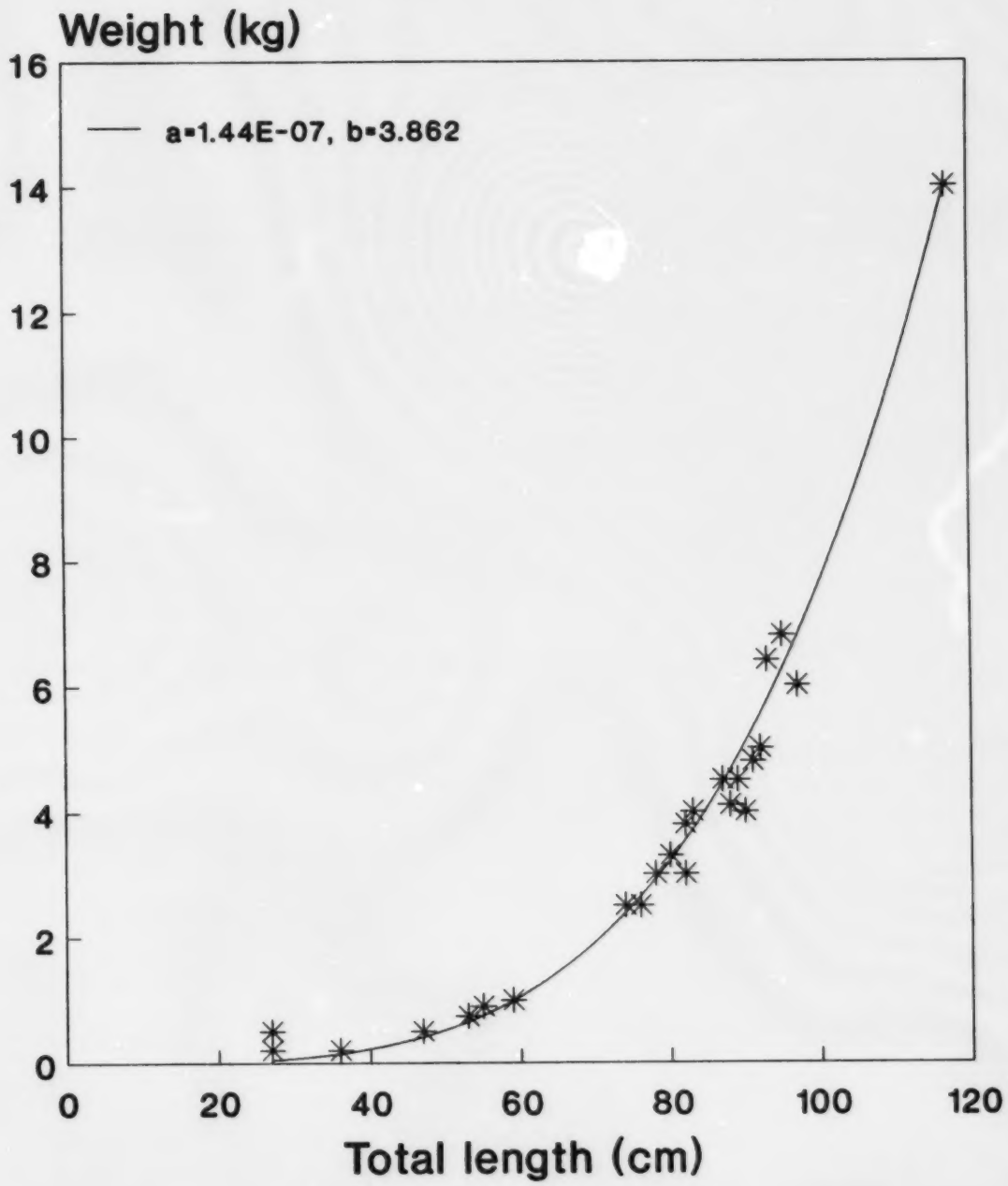

Fig. 4. Length-weight relationship for Longnose skate (Raja rhina) caught on species assemblage survey of Hecate Strait by R/V W.E. RICKER, June 3-22, 1991.

Appendix tables, pages 27 through 179, appear in microfiche format at the back of this report.